19. (New) Apparatus according to Claim 6, wherein the plurality of directions are angularly spaced apart about 45 degrees.

20. (New) A program storage device according to Claim 11, wherein the plurality of directions are angularly spaced apart about 22 ½ degrees.

21. (New) A program storage device according to Claim 11, wherein the plurality of directions are angularly spaced apart about 45 degrees.

REMARKS

In the Office Action, the Examiner rejected Claims 1-15, which were all of the then pending claims, under 35 U.S.C. §102 as being fully anticipated by U.S. Patent 5,398,292 (Aoyama).

Independent Claims 1, 6 and 11 are herein being amended to better define the invention, and Claims 3, 8 and 13 are being cancelled to reduce the number of pending claims. Claims 4, 5, 9, 10 and 14 are being amended to maintain proper dependency among the claims, and to keep the language of these dependent claims consistent with the language of the respective independent claims from which they depend. New Claims 16-21 are being added to describe preferred features of the invention. Claims 16 and 17 are dependent from Claim 1, Claims 18 and 19 are dependent from Claim 6, and Claims 20 and 21 are dependent from Claim 11.

For the reasons advanced below in detail, Applicants respectfully submit that Claims 1, 2, 4-7, 9-12, and 14-21, as presented herewith, patentably distinguish over the prior art and are allowable. The Examiner is, accordingly, respectfully requested to reconsider and to withdraw the rejection of claims 1, 2, 4-7, 9-12, 14 and 15 and to allow these claims and new Claims 16-21.

The present invention, generally, relates to methods and apparatus for measuring two-dimensional submicron structures or shapes. More specifically, this is done by determining the edges of those structures or shapes. These shapes can have many specific forms, and the edges of the shapes can extend in various directions and change directions as the perimeter of the shapes are traversed.

Aoyama discloses a procedure for detecting a white line on a road in order to implement automatic driving of a vehicle. In this procedure, a series of masks are laid over the line, generally along the direction of the line, in order to determine more precisely the direction of that line. To optimize the procedure, the masks are oriented so that the longitudinal direction of the masks is along the direction of the line.

There are a number of important general differences between the present invention and the procedure disclosed in Aoyama. For example, the procedure of Aoyama determines the exact direction of an approximately straight line, while the procedure of the present invention is used to determine the edge of a structure that may have significant curves, bends and corners. In addition, the present invention may be effectively used to determine the shape of submicron structures, while Aoyama is used to determine the direction of a line that is, obviously, many orders of magnitudes larger.

These general differences between this invention and Aoyama are reflected in a number of more specific differences. For instance, with the present invention, a plurality of scans are taken across substantially the same point of the edge, while in Aoyama, the masks used to determine the direction of the line are places next to each other, and are not placed over substantially the same point in the line.

Independent Claims 1, 6 and 11 are herein being amended to emphasize this feature of the invention. In particular, each of these claims is being amended to indicate that the intensity vs. pixel information is selected in a plurality of different directions, through substantially the same point, in the vicinity of the edge of the image shape.

This feature of the invention is of utility because it helps track an edge that may change directions suddenly and significantly. The line being followed in Aoyama, it may be noted, does not change directions in this way; and, hence, there is no reason to modify the Aoyama procedure to scan across the line as is done in the present invention.

The other references of record, which were cited in Applicants' Information Disclosure Statement, have been reviewed, and these references are believed to be no more pertinent than Aoyama.

Because of the above-discussed differences between Claims 1, 6 and 11 and the prior art, and because of the advantages associated with those differences, these Claims patentably distinguish over the prior art and are allowable. Claims 2, 4, 5, 16 and 17 are dependent from, and are allowable with, Claim 1; and Claims 7, 9, 10, 18 and 19 are dependent from Claim 6 and are allowable therewith. Similarly, Claims 12, 14, 15, 20 and 21 are dependent from, and are allowable with, Claim 11. The Examiner is, accordingly, respectfully asked to

reconsider and to withdraw the rejection of Claims 1, 2, 4-7, 9-12, 14 and 15 and to allow these Claims and new Claims 16-21.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached pages are captioned "**Version with Marking to Show Changes made**."

Every effort has been made to place this case in condition for allowance, a notice of which is requested. If the Examiner believes that a telephone conference with Applicants' Attorneys would be advantageous to the disposition of this case, the Examiner is asked to telephone the undersigned.

Respectfully Submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

Please cancel Claims 3, 8 and 13.

Please amend Claims 1, 4, 5, 6, 9, 10, 11 and 14, and add new Claims 16-21 as set forth below.

1. (Once Amended) A method of extracting two-dimensional image shapes from a two-dimensional array of pixel data, the method comprising the steps of:

selecting intensity vs. pixel information in [at least one] a plurality of different directions, through substantially the same point, in the vicinity of an edge of the image shape;

recognizing scans with sufficient contrast as containing edge information;

subjecting acceptable scans to an edge detection algorithm;

detecting the edge location of the image by using said edge detection algorithm; and

generating a locus of points that define the two-dimensional shape of the image from the detected edge values.

4. (Once Amended) A method according to Claim [3] 1, wherein the selecting step includes the step of selecting intensity vs. pixel information in at least four directions.

5. (Once Amended) A method according to Claim 1, wherein [said at least] one of said directions is normal to the approximate edge location.

6. (Once Amended) Apparatus for extracting two-dimensional shape information from an image, of a submicron structure, formed on an array of detectors, comprising:

means for determining intensity vs. detector location information for detectors on [at least one] a plurality of scans in [at least one] a plurality of different directions, through substantially the same point, in the vicinity of an edge of the image;

means for processing identified scans according to an edge detection algorithm to identify points on the edge of the image; and

means for generating a locus of points that define the two-dimensional shape of the structure from the identified edge points.

9. (Once Amended) Apparatus according to Claim [8] 6, wherein the plurality of directions includes at least four directions.

10. (Once Amended) Apparatus according to Claim 6, wherein [said at least] one of said directions is normal to an approximate edge location.

11. (Once Amended) A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform method steps for extracting

two-dimensional image shapes from image data on a pixel array, the method steps comprising:

selecting intensity vs. pixel information in [at least one] a plurality of different directions, through substantially the same point, in the vicinity of an edge of the image shape;

recognizing scans with sufficient contrast as containing edge information;

subjecting acceptable scans to an edge detection algorithm;

detecting the edge location of the image by using said edge detection algorithm; and

generating a locus of points that define the two-dimensional shape of the image from the detected edge values.

14. (Once Amended) A program storage device according to Claim [13] 11, wherein the selecting step includes the step of selecting intensity vs. pixel information in at least four directions.

16. (New) A method according to Claim 1, wherein the plurality of directions are angularly spaced apart about 22½ degrees.

17. (New) A method according to Claim 1, wherein the plurality of directions are angularly spaced apart about 45 degrees.

18. (New) Apparatus according to Claim 6, wherein the plurality of directions are angularly spaced apart about 22 ½ degrees.

19. (New) Apparatus according to Claim 6, wherein the plurality of directions are angularly spaced apart about 45 degrees.

20. (New) A program storage device according to Claim 11, wherein the plurality of directions are angularly spaced apart about 22 ½ degrees.

21. (New) A program storage device according to Claim 11, wherein the plurality of directions are angularly spaced apart about 45 degrees.